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least, several characters must reside in one chromosome. The characters must then be confined to separate particles or corpuscles of the chromosomes, and an interchange of homologous particles according to chance during maturation would give the Mendelian combinations. Many observers, including STRASBURGER, ROSENBERG, ALLEN, and SCHREINER, have described such an interchange of particles; but GRÉGOIRE's conclusion, which he has emphasized before, is that nothing in the observations of the nuclear reticulum, the somatic spirem, or the heterotypic spirem justifies the admission of representative particles, chromatic or achromatic. The "chromomeres" observed particularly in the heterotypic spirem, he considers not as autonomous granules imbedded in a substratum, but merely as a substratum impregnated with chromatic material and rather regularly alveolated, giving the appearance of a single or double row of "chromomeres."

GRÉGOIRE further denies that there is an interchange of particles between the parallel filaments in the double spirem stage, such as various cytologists have described. These two facts, namely, the presence of autonomous particles and their free interchange at some time during the reduction processes, would appear to be essential to a cytological basis for Mendelian phenomena.—R. R. GATES.

Extra-floral nectaries and "myrmecophily."—To many who have held the untenable view that plant structures are necessarily useful, extra-floral nectaries have been a stumbling-block. NIEUWENHUIS-UExKÜLL⁹ has made an exhaustive study of the extra-floral nectaries of 100 species of plants growing at Buitenzorg, and it may be said that these studies are of great importance because they show conclusively that we know nothing concerning the advantage of these peculiar organs. There is an admirable critical review of the treatises that consider extra-floral nectaries, beginning with HALL's study in 1762. The term extra-floral nectary was first employed by CASPARY in 1848, who rather inclined toward LIEBIG's theory that they are of value to plants as a means of excreting sugar when present in excess. The classic study of these organs is DELPINO's treatise issued in 1874, in which the term extra-nuptial nectaries is employed, and the idea advanced that the sugar they secrete attracts ants; these insects in turn are supposed to defend such plants against their enemies. Simultaneously with DELPINO, BELT proposed a similar theory for *Acacia sphaerocephala*, and from then until very recently botanists have generally believed in the existence of myrmecophiles, or ant-loving plants. Among the supporters of myrmecophily have been DARWIN, FRITZ MÜLLER, TRELEASE, and SCHIMPER. BONNIER (1878) regarded all nectaries as sugar reservoirs, any other function being thought quite incidental, and KERNER (1878) regarded extra-floral nectaries as protective against "unbidden guests." Beginning with the skeptical attitude taken toward myrmecophily by VON IHERING in 1894, there have been critical contributions by

⁹ NIEUWENHUIS VON UExKÜLL-GÜLDENBANDT, M., Extraflorale Zuckerauscheidungen und Ameisenschutz. Ann. Jard. Bot. Buit. II. 6:195-327. 1907.

RETTIG, ULE,¹⁰ and others, all of which are out of harmony with the myrmecophile hypothesis. The work of NIEUWENHUIS-UEXKÜLL confirms these more recent views.

After a detailed account of extra-floral nectaries by plant families, the author summarizes the data presented, and some of the chief conclusions follow. The structure and form of the nectaries do not favor the theory that they originated as adaptations for ant protection; in many cases they specifically oppose such an assumption, and their position on the plant (largely on the leaf undersurface) is such as to be of no purposive significance. The secretions often begin late in life, so that the plant is without protection in youth, when it is most needed. In other cases the secretion begins in early youth and soon ceases, thus leaving the plant for a long time without ant protection, if such exists. The nectaries usually secrete sugar somewhat spasmodically during their period of activity, and are often dry. The nectar of many species is avoided by ants and other animals. The view that the honey-seeking ants drive off crawling insects and other "unbidden guests" that mutilate the flowers, robbing them of honey or pollen, is quite untenable, there being no relation between mutilated flowers, ants, and extra-floral nectaries. Floral mutilation depends on the structure and position of the flower or the weather; furthermore, most mutilated flowers produce as many seeds as flowers that are not mutilated. The honey-seeking ants are not combative and do not attack other insects on the plants they visit; indeed, these other insects often attack and repel the ants. The nectaries, therefore, so far from being beneficial structures developed by natural selection, are harmful to the plants of which they are a part, in that they attract insects of all kinds, which not only eat the sugar but do harm in various ways. Observation showed that individual plants which secreted little or no nectar are less harmed by insects than are those that produce nectar.

This paper, in addition to other recent work, makes it clear that myrmecophily is a figment of the imagination, and the word should be dropped from botanical literature. Ants may "love" plants, but there is no evidence that plants "love" ants. Plants inhabited by these insects, if it seems worth while to group them, may be called myrmecophytes.—H. C. COWLES.

A Mendelian ratio and latency.—SHULL¹¹ in a suggestive paper makes further contributions to Mendelian theory. In certain bean hybrids three distinct units were shown in earlier papers¹² to be involved, namely, a pigment factor, a blackener, and a mottled pattern. In the last character a peculiar condition is found, namely, the mottled pattern depends upon the presence of a mottling allelo-

¹⁰ See BOT. GAZETTE 44:314. 1907.

¹¹ SHULL, GEO. H., A new Mendelian ratio and several types of latency. Amer. Nat. 42:433-451. 1908.

¹² ———, The significance of latent characters. Science 25:792. 1907; Some latent characters of a white bean. *Idem* 25:828. 1907.